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PHARMACEUTICAL E-COMMERCE SALES FORECASTING USING GM(1,1) AND SVR REVIEW

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ABSTRACT - The pharmaceutical e-commerce industry has rapidly expanded due to digitalization and increased Online healthcare purchases are preferred by consumers.In this industry, demand planning, inventory control, and customer happiness all depend on accurate sales forecasting.The Grey Model (GM(1,1)) and Support Vector Regr ession (SVR) are combined in this project's hybrid predictive model to forecast pharmaceutical e- commerce sales effectively. The GM(1,1) model is employed to identify short-term patterns in limited datasets, while SVR refines predictions by capturing non-linear relationships in sales behavior. The hybrid model leverages the strengths of both statistical and machine learning approaches, offering improved accuracy and adaptability compared to individual models. Experimental simulations using monthly sales data demonstrate that the GM(1,1)- SVR model significantly reduces forecasting errors. This approach helps businesses in optimizing stock control, minimizing wastage of medicines, and improving supply chain decisions. The proposed model can serve as a reliable decision-support tool for pharmaceutical e-commerce companies aiming to enhance operational efficiency and responsiveness to market dynamics.

I. INTRODUCTION

Pharmaceutical ecommerce platforms have emerged as a crucial conduit for the direct delivery of healthcare produc ts to customers in today's cutthroat digital economy.Accurately predicting sales has become critical due to the growi ng demand for online medications, vitamins, and healthcare necessities.adequate stock and preventing shortages or overproduction. Traditional time-series models, such as ARIMA, often fail to handle small and uncertain datasets effectively, especially in emerging e-commerce markets. To overcome this limitation, the Grey Model (GM(1,1)) provides a powerful statistical tool that can model uncertain and limited data efficiently. Meanwhile, Support Vector Regression (SVR), a machine learning algorithm, enhances

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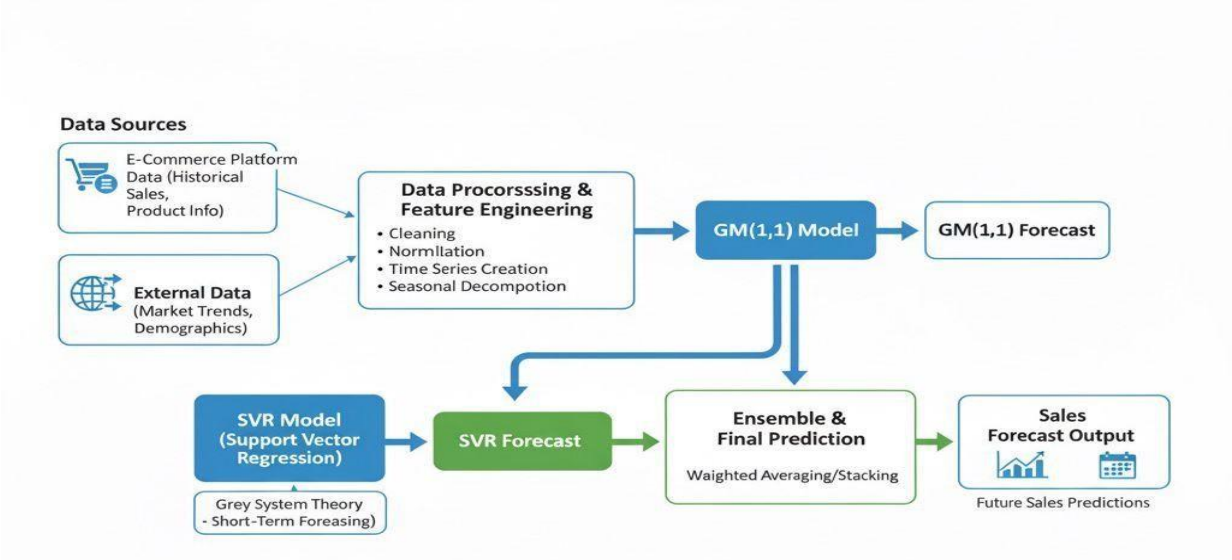
prediction accuracy by learning complex non-linear patterns. The integration of GM(1,1) and SVR creates a hybrid forecasting model capable of adapting to dynamic sales patterns influenced by factors like seasonality, promotions, and health trends. This study focuses on developing and testing the hybrid GM(1,1)-SVR model to forecast monthly pharmaceutical e-commerce sales, aiming to improve demand prediction accuracy and assist management in strategic decision-making.

II. METHODOLOGY

The suggested approach creates a hybrid forecasting framework by combining Support Vector Regressin and Grey System Theory.The first step in the study process is data collecting, which involves gathering past sales information from pharmaceutical e-commerce transactions.

Preprocessing of the data includes outlier analysis and normalization.removal, to enhance model performance. The first stage involves applying the GM(1,1) model, which identifies general sales trends using limited samples. GM(1,1) predicts the primary growth pattern through its cumulative generation process, making it suitable for short-term trend estimation. In the second stage, the residual errors from the GM(1,1) model are used as input for SVR. The SVR algorithm, employing a radial basis function (RBF)kernel, captures complex non-linear variations and corrects the inaccuracies of GM(1,1). Both models are trained and validated using a portion of the dataset, and performance is evaluated using statistical accuracy measures such as Mean Absolute Percentage Error (MAPE) and Root Mean Square Error (RMSE). Finally, results from both models are compared to demonstrate the effectiveness of the hybrid approach in producing more stable andprecise sales forecasts for the pharmaceutical e-commerce industry.

III. SYSTEM ARCHITECTURE



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IV. SYSTEM REQUIREMENTS

Hardware Requirements

- **Processor:** Intel Core i3 or above
- **RAM:** Minimum 4 GB (8 GB recommended for faster computation)
- **Storage:** At least 2 GB free disk space for datasets and models
- **Operating System:** Windows 10 / Linux / macOS
- **Graphics:** Basic GPU support (optional for SVR computation acceleration)

Software Requirements

- **Programming Language:** Python 3.8 or higher
- **Libraries:** NumPy, Pandas, Scikit-learn, Matplotlib, GreySystem, and Jupyter Notebook
- **Development Environment:** VS Code, PyCharm, or Jupyter Notebook
- **Database:** CSV/Excel files or SQL database for storing e-commerce sales data
- **Tools for Visualization:** Matplotlib / Seaborn for plotting trends and results
- **Optional Integration:** Web dashboard for real-time forecasting output

V. ADVANTAGES OF THE SALE FORECASTING

- **High Forecast Accuracy:** By combining GM(1,1) and SVR, the hybrid model provides more accurate and reliable forecasts than using a single method.

- **Works with Small Data:** GM(1,1) performs well with limited or incomplete sales data, making the system practical for new or growing e-commerce companies.

- **Captures Non-Linear Trends:** The SVR component effectively models non-linear and seasonal patterns, improving predictions during promotions or demand spikes.

- **Improves Inventory Management:** Accurate forecasting helps avoid overstocking and stockouts, reducing losses due to expired or unavailable medicines.

- **Enhances Decision-Making:** The model supports data-driven strategies for pricing, marketing, and logistics, leading to better business planning.

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VI. CONCLUSIONS

The project **"Pharmaceutical E-Commerce Sales Forecasting Using GM(1,1) and SVR"** successfully demonstrates the effectiveness of combining statistical and machine learning techniques for accurate sales prediction.Finds general sales trends from sparse data, and the SVR model enhances the findings by identifying intr icate, non-linear patterns. When combined, they offer a strong hybrid forecasting system that improves decision-making, maximizes inventory control, and reduces operational costs for pharmaceutical e-commerce businesses. The proposed model ensures better demand planning and customer satisfaction, making it a valuable tool for data-driven growth in the digital healthcare marketplace.

REFERENCES

[1] Improving Hybrid Models for Precipitation Forecasting by Combining Nonlinear Machine Learning Methods (2023) – combines SVR with other nonlinear models in a hybrid forecasting framework. SpringerLink

[2] Application of a Modified Grey Model Based on Least Squares in Energy Prediction (2023) – focuses on a modified GM(1,1) model. clausiuspress.com

[3] The Predictive Grey Forecasting Approach for Measuring Tax Collection (2023) – applies GM(1,1) to real-world data and discusses grey system theory. MDPI

[4] A Comparative Analysis of Traditional Forecasting Methods and Machine Learning Techniques for Sales Prediction in E-Commerce (2023) – examines sales forecasting in e-commerce using ML approaches (though not exactly GM+SVR, it is in your domain). americaspg.com

[5] Exploring Hybrid ARIMA-SVR Approach for Forecast of Gross Cropped Area of Kerala in India (2025, but close) – uses a hybrid time-series + SVR approach which is relevant methodologically